NOTES AND NEWS

ZONING AS AN EXPLANATION OF OPTICAL ANOMALIES OF A PLAGIOCLASE FELDSPAR IN QUARTZ-BEARING PLUTONITES FROM VERMONT

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The "granites" of Vermont have long been famous as a source of monumental stone. In 1909, Dale[1] of the U. S. Geological Survey, made the most extensive study of these rocks that has been made to date, although he states it was not "an exhaustive geologic and petrographic account of the Vermont granites."

In 1934, Maynard[2] restudied some of these rocks and arrived at conclusions which differed considerably from those of Dale. Whereas Dale had reported orthoclase in many of these plutonites, Maynard found orthoclase in only two of the eight specimens that he studied. From his work on the "Bethel white granite" he found that "Oligoclase of the composition *Ab* 82 *An* 18, instead of quartz, as stated by Dale, is the most abundant constituent . . . . Orthoclase was not found in the thin section studied or in any of the numerous samples that were crushed and examined in oils. It is probable that Dale mistook some of the oligoclase for orthoclase as much of it does not show albite twinning, and quite often does show Carlsbad twinning."

Maynard's study led him to conclude that because of the abundance of plagioclase feldspar in these rocks, the paucity of twinning on the albite law, and the almost complete absence of orthoclase, it might be of value to study the plagioclase in detail to see if its optical and chemical properties corresponded with those given in the literature. This paper deals mainly with the optical phase of this problem.

The three specimens used in this study were collected (1) from the Newport Granite Company's quarry, near the center of the town of Derby; (2) along the road connecting Greensboro and East Craftsbury, just north of the town of Greensboro; and (3) from the Woodbury Granite Company's quarry on Robeson Mountain, east of the town of Woodbury.

The plagioclase which occurs in these rocks is unique in that the majority of the grains do not show albite twinning. Some however do show a patch of albite twinning near the center of the grain, or more rarely are completely twinned according to this law. Occasionally twin-

[1] Dale, T. N., The granites of Vermont, *U. S. Geol. Survey*, Bull. **404,** 1909.

[2] Maynard, James E., The re-examination of quartz-bearing plutonites from Vermont: *Jour. Geol.*, vol. **42,** no. 2, 1934.

ning according to the Carlsbad law, and a combination of Carlsbad and albite twinning is present. Much of the feldspar shows pronounced zoning. Inclusions of sphene, apatite, and possibly zircon, are present in varying amounts. Alteration products of the feldspar are kaolin, muscovite, calcite and epidote.

The refractive indices were determined for each specimen by the immersion method using monochromatic light. This procedure served to outline the limits of the zoning and gave some idea as to the average composition. With the exception of the Greensboro specimen the limits ranged between *Ab* 76 and *Ab* 84.

The extinction angles were measured between the fast ray and traces of the {010} and {001} cleavages. The compositional limits indicated by these angles all fall within one per cent of a range of *Ab* 74 to *Ab* 87, a greater variation than is shown by the refractive indices, which are no doubt more accurate. The average composition of the plagioclase, computed for all specimens, from the refractive indices and extinction angles, varies between *Ab* 80 and *Ab* 81.

A total of ten optic signs was determined for each specimen from good optic axis figures, and from six to ten of these were positive in each case. Since a positive optic sign indicates a composition varying between *Ab* 84 and *Ab* 100, the high percentage of positive signs is anomalous with respect to the composition indicated by the other optical properties, which show that a composition of *Ab* 84 is near the extreme acid limit of the zoning.

No reason for this apparent anomaly was suggested until the zoning of the plagioclase was examined in some detail. This study showed that in the majority of the grains the zoning was of the reverse type, having sodic cores and becoming progressively more calcic toward the borders. This type of zoning is relatively rare and has never been reported for these rocks. Larsen[3] and his associates have recently noted its occurrence in the plagioclase of the San Juan lavas.

It seems logical to conclude that zoning of this type would yield a greater number of positive optic signs than negative, in spite of the fact that the average composition was more basic than *Ab* 84. A grain having a sodic core could have a thin zone of calcic feldspar at the outer border which would more than equal the volume of the inner zones. The optic sign would be determined by the more compact sodic core, whereas the composition of the grain as a whole would be more calcic than indicated, due to the more calcic outer zones. Grains which in sectioning had been

[3] Larsen, E. S., and others, Petrographic results of a study of the minerals from the Tertiary volcanic rocks of the San Juan region, Colorado: *Am. Mineral.*, vol. **23**, pp. 230–231, 1938.

cut through and parallel to one of the calcic zones would properly show a negative sign, but these would be less frequent than grains showing a positive sign.

It will be necessary to make a chemical analysis of the plagioclase in each rock to conclusively establish its actual composition. The first of these analyses has been made for the Derby rock and the results are:

SiO_2	60.83
Al_2O_3	22.22
Fe_2O_3	0.93
TiO_2 & ZrO_2	1.07
MgO	0.40
CaO	4.84
Na_2O	8.44
K_2O	0.62
H_2O	0.90
	100.25

The composition in weight per cent, calculated from the analysis to 100% is:

Orthoclase	4%
Albite	72%
Anorthite	24%

Since nearly all the standard tables in the literature treat plagioclase as a two component series, it seems justifiable to include the orthoclase with the albite, giving a composition of *Ab* 76 *An* 24 for this feldspar. This single analysis does not carry much weight, but it indicates that the anomaly between certain of the optical properties, as a result of reverse zoning, is more important than seems apparent from optical data alone.

LOSS OF NICKEL FROM METEORITES THROUGH WEATHERING

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The failure of meteorites to appear in any of the pre-glacial formations has long been a puzzle to geologists as well as to students of meteorites. Suggestions relative to the recognition of meteorites have usually been based on the assumption that the nickel content should be regarded as the best indication of meteoritic origin. In 1929 the writer pointed out that in oxidized specimens from Brenham, Kiowa County, Kansas, the nickel content had shrunken proportionately far more than had the iron content from the original composition as determined on well-preserved specimens of the same fall.